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## (57)Abstract:

PROBLEM TO BE SOLVED: To obtain good dispersibility in an insulating liquid and good releasing property of the insulating liquid and to properly control the particle size and charge amt. by dispersing a toner which contains a rosin ester, epoxy resin having specified glass transition temp. and a pigment in an insulating liquid.

SOLUTION: The liquid developer is prepared by dispersing a toner in an insulating liquid. The toner contains 20 to 90wt.% rosin ester based on the toner weight, 10 to 80wt.% epoxy resin or polyester resin having  $\leq 50^{\circ}\text{C}$  glass transition temp., and 5 to 60wt.% pigment. As for the rosin ester, an ester gum, pentaerythritol ester of rosin, rosin-modified maleic acid resin, etc., can be used. The rosin ester is present in a dissolved or half-dissolved state in the insulating liquid, and the solubility of the rosin ester can be controlled by changing the kinds of ester groups in the rosin ester.

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(54) 【発明の名称】 液体現像剤

(57) 【要約】

【課題】 絶縁性液体中での分散性や絶縁性液体の離脱性が良好で、粒径や帯電量の制御を適切に行なうことができ、転写性や定着性が良好な液体现像用の現像剤及び液体现像用バインダーを提供する。

【解決手段】 トナー重量換算でそれぞれ、20～90重量%のロジンエステルと、10～80重量%のガラス転移温度が50℃以下のエポキシ樹脂又はポリエステル樹脂と、5～60重量%の顔料とを含むトナーを絶縁性液体中に分散せしめてなることを特徴とする液体现像剤。

## 【特許請求の範囲】

【請求項1】 トナーを絶縁性液体中に分散してなる液体現像剤において、

前記トナーは、トナー重量換算で、ロジンエステル20～90重量%と、ガラス転移温度が50℃以下のエポキシ樹脂またはポリエステル樹脂10～80重量%と、顔料5～60重量%とを含むことを特徴とする液体現像剤。

【請求項2】 ロジンエステルと、エポキシ樹脂またはポリエステル樹脂とは、ロジンエステル：エポキシ樹脂またはポリエステル樹脂＝90：10～20：80の重量比で配合される、請求項1記載の液体現像剤。

【請求項3】 ロジンエステルは10～150の酸価を有するものである請求項1又は2に記載の液体現像剤。

【請求項4】 ロジンエステルは、エステルガム、ロジンのペンタエリスリトールエステル、ロジン変性マレイン酸樹脂、又はロジン変性フェノール樹脂である請求項1～3のいずれか1項に記載の液体現像剤。

【請求項5】 絶縁性液体は炭素数9～15であり、沸点200℃以下のイソパラフィン系炭化水素である請求項1～6のいずれか1項に記載の液体現像剤。

【請求項6】 現像時のトナーは0.05μm～2.0μmの範囲の粒径を有することを特徴とする請求項1～5のいずれか1項に記載の液体現像剤。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】 本発明は複写機等の現像に用いる現像剤に係り、更に詳細には、湿式現像法に使用する液体現像剤に関する。

## 【0002】

【従来の技術】 従来より、複写機やレーザービームプリンター等の画像形成装置では、一般に、原稿から読み取った画像情報を感光体ドラム上に書き込んで静電潜像を形成し、この静電潜像にトナーを付着させる現像を行なって未定着トナー像を形成し、次いでこの未定着トナー像を用紙などに転写し、加圧下に加熱して定着するようになっている。

【0003】 上記現像する際に用いるトナーは熱可塑性樹脂の微粒子からなり、このトナーの粒径がサブミクロンオーダーの適正な範囲の大きさのときに画像密度が高い高品質の画像が得られることが知られている。

【0004】 ところで、現像方法の種類には、トナーのみを用いて現像する乾式現像法と、トナーの他に絶縁性の液体を用いて現像する湿式現像法の二つがあり、これらの方法にはそれぞれ長所と短所とがある。

【0005】 即ち、乾式現像法は現像に液体を使用しないので現像剤の取り扱いが容易であるという長所を有する反面、使用できるトナーは数ミクロンオーダーの比較的粒径の大きいものに限られるため、階調度の高い繊細な画像を形成することが困難であるという短所がある。

【0006】 一方、湿式現像法では乾式現像法に比べて粒径の小さいトナーを用いることができるため、緻密で繊細な画像を形成できるという長所がある反面、下記のような短所がある。

【0007】 まず、湿式現像法で用いるトナーは、絶縁性液体に対して安定した分散性と離脱容易性とを有することが求められるが、この分散性と、離脱容易性とを備えたトナーを得るのが困難であるという問題がある。

【0008】 即ち、トナーはこの絶縁性液体中で沈殿したり凝集することなく安定して分散する性質を備えていなければならない。また、現像が終了して感光体ドラム上に未定着トナー像が形成された後は絶縁性液体はもはや不要であるため、形成された未定着トナー像から速やかに除去できることが求められ、そのためにはトナーと絶縁性液体とは良好な離脱性を備えていなければならない。

【0009】 次に、高品質の画像を得るためには、未定着トナー像を形成するトナーの粒径がサブミクロンオーダーの範囲の適正な大きさであることが求められ、そのためには絶縁性液体中で分散している間にトナーの粒径を制御することが必要であるが、絶縁性液体中でトナーの粒径を制御することは困難であるという問題がある。

更に、湿式現像法では絶縁性液体中に分散している間にトナーが帯電し、高品質の画像を得るためにはトナーの帯電量が適正であることが求められるが、絶縁性液体中で帯電量を制御することは困難であるという問題がある。

【0010】 また、湿式現像法では乾式法と比較して未定着トナー像が緻密になるが、この未定着トナー像の密度にも適正な範囲があり、これより高密度になると未定着トナー像が緻密になり過ぎて感光体ドラム表面から剥がれ難くなり、未定着トナー像を用紙に転写するのが困難になる。そのため、この転写に支障が生じない程度の密度に制御する必要があるが、この未定着トナー像の密度を制御するのが困難であるという問題がある。

【0011】 更に、湿式現像法では一般にバインダーを構成する樹脂に対して顔料の比率が高いため、定着しにくいという問題がある。

## 【0012】

【発明が解決しようとする課題】 上記のように湿式現像法には、絶縁性液体中での分散性、絶縁性液体の離脱性、粒径や帯電量の制御、転写性、及び定着性の問題があるものの、画像を構成するトナーとして最も好適であるサブミクロンオーダーの範囲の粒径のトナーを使用できる点で有利であり、上記のような問題を克服することができれば、乾式現像法では得られない高品質の画像が得られる点で魅力の大きな現像法である。そして特に画像の高品質化が求められる昨今においてはその画質の良さが見直されているため、上記問題を克服できるような現像剤の開発が望まれていた。

【0013】そこで、本発明者らは鋭意研究した結果、バインダーとして特定のロジンエステルと特定のエポキシ樹脂またはポリエステル樹脂との混合物を使用することにより、上記従来の湿式現像法用現像剤の問題を克服できることを見だして本発明を完成した。

【0014】従って、本発明の目的とするところは、絶縁性液体中での分散性や絶縁性液体の離脱性が良好で、粒径や帯電量の制御を適切に行なうことができ、転写性や定着性が良好な液体現像用の現像剤を提供することにある。

【0015】

【課題を解決するための手段】本発明の液体現像剤は、ロジンエステルと、ガラス転移温度が50℃以下のエポキシ樹脂またはポリエステル樹脂と、顔料とを含むトナーを絶縁性液体中に分散せしめてなることを特徴とする。

【0016】本発明においてロジンエステルは、分散時のトナーの粒径の制御を容易にする機能を果たすものである。

【0017】このロジンエステルは上記絶縁性液体中で溶解あるいは半溶解状態で存在するものであり、この絶縁性液体に対する溶解性はロジンエステルのエステル基の種類を変化させることにより調節することができる。この溶解性はまたロジンエステルの酸価とも関係し、酸価の適正なロジンエステルを選択することにより、ロジンエステル、ひいてはトナーの溶解性を調節することができる。

【0018】ロジンエステルのエステル基は小さいほど溶解性が良くなる。例えばメタノールエステルやエチレングリコールエステルを用いた場合は溶解し易くなり、グリセリンエステルやペンタエリスリトールエステルを用いた場合には溶解し難くなる。

【0019】また、ロジンエステルのもう一つの機能は顔料との馴染みを良くするものであり、顔料表面に吸着することにより優れた顔料分散性を与えることである。

【0020】更に、ロジンエステルの他の機能は多くの樹脂に対する優れた相溶性を有することである。

【0021】かかる観点から、本発明で用いるロジンエステルとしては、10～150の酸価を有するものが好ましい。ここで酸価を10～150の範囲としたのは、酸価を10以上にすることが、顔料の分散性を高め、トナーが絶縁性液体中に分散させたときの帯電性制御上好ましいという理由からであり、反対に酸価が150より高いとトナーの絶縁性液体中での分散性が不安定化するという問題が生じるからである。

【0022】本発明で用いるロジンエステルとしては、エステルガム、ロジンのペンタエリスリトールエステル、ロジン変性マレイン酸樹脂、ロジン変性フェノール樹脂が挙げられる。

【0023】本発明で用いるロジンエステルの配合量

は、トナー重量換算で、20～90重量%の範囲が好ましい。ここで上限を90重量%としたのは、これより多いとロジンエステルの分散媒中への溶解成分が現像特性に影響を与えたり、分散媒中で膨潤したトナー粒子が凝集したりするという問題があるからであり、反対に下限を20重量%としたのは、これより少ないと、トナー粒子の分散媒中での分散安定性が悪く、またトナーに安定な帯電性を付与しにくいという問題があるからである。

【0024】本発明で用いるエポキシ樹脂又はポリエステル樹脂はガラス転移温度が50℃以下であることが求められる。ここでガラス転移温度を50℃以下としたのは、ガラス転移温度がこれより高いとトナーの定着性が低下するからである。

【0025】定着性を更に容易ならしめるには、これら樹脂のガラス転移温度を更に低く、例えば-20℃～30℃程度の範囲に設定することが望ましい。

【0026】本発明で用いるエポキシ樹脂又はポリエステル樹脂はトナー粒子の樹脂成分を分散媒に不溶ならしめ、トナーが着色した熱可塑性の粒子として機能せしめるものであり、代表的にはビスフェノールAとエピクロロヒドリンとから作られる樹脂やこれらの変性物を用いることができる。

【0027】本発明で用いるエポキシ樹脂の他の例としては、フェノールノボラック型エポキシ樹脂、クレゾールノボラック型エポキシ樹脂、環状脂肪族エポキシ樹脂、グリシジルエステル系エポキシ樹脂、グリシジルフタレート系エポキシ樹脂が挙げられる。また、ポリエステル樹脂としては、フタル酸、イソフタル酸、トリメリット酸等の多価基酸とビスフェノールA、ブタンジオール、エチレングリコール、グリセリン等の多価アルコールとの縮合物が挙げられる。

【0028】本発明で用いるエポキシ樹脂又はポリエステル樹脂の配合量は、トナー重量換算で、10～80重量%の範囲が好ましい。ここで上限を80重量%としたのは、これより多いとトナーの分散媒中への分散安定性が劣化し、また、トナーに適正な帯電を付与することが困難になること、更に顔料の分散性も悪くなるという問題があるからであり、下限を10重量%としたのは、これより少ないとトナーが分散媒に溶解しやすくなり、現像とともに蓄積した溶解成分が現像特性を劣化させるという問題があるからである。

【0029】本発明において、顔料とは、トナーに対して色を与える機能を有するものであり、本発明に用いる顔料としては、カーボンブラック、フタロシアニンブルー、ジメチルキナクリドン、カーミンレッド、ベンジジンイエローが挙げられる。

【0030】本発明で用いる顔料の配合量は、トナー重量換算で、5～60重量%の範囲が好ましい。ここで上限を60重量%としたのは、これより多いとトナーの定着が困難となり、光沢のある画像が得られないという問

題があるからであり、下限を5重量%としたのは、これより少ないと現像剤が十分に濃い濃度に達し得ないという問題があるからである。

【0031】また、上記のロジンエステル及びエポキシ樹脂又はポリエステル樹脂は、ロジンエステル：エポキシ樹脂又はポリエステル樹脂＝90：10～20：80の範囲の重量比で配合されるのが好ましい。エポキシ樹脂又はポリエステル樹脂に対するロジンエステルの割合が20：80より少なくなるとトナーの分散媒中での分散安定性が悪くなり、トナーに適正な帯電を付与することが困難になるという問題があるからであり、反対にエポキシ樹脂又はポリエステル樹脂に対するロジンエステルの割合が90：10より多くなるとトナーの分散媒中への溶解成分が増し、現像を続けるとこれがさらに増加して現像剤を劣化させたり、トナー粒子の凝集が起こりやすくなるという問題があるからである。

【0032】本発明で用いる絶縁性液体は、現像剤を分散させる絶縁性液体として機能するものである。

【0033】本発明で用いる絶縁性液体としては、 $10^{13} \Omega$ 以上の絶縁抵抗を有する有機液体が好ましい。ここで絶縁抵抗を $10^{13} \Omega$ 以上としたのは、絶縁抵抗が $10^{13} \Omega$ より低いと、現像時に静電潜像の電荷が漏洩して現像画像濃度が低下するという問題があるからである。

【0034】本発明で用いる絶縁性液体としては、液状パラフィン、シリコンオイル、ケロシン、鉱物油、機械油が挙げられる。このうち、特に好ましいのは炭素数9～15であり、沸点 $200^{\circ}\text{C}$ 以下のイソパラフィン系炭化水素は、現像剤が揮散して乾燥できる点からハンドリング性に優れている。

【0035】本発明で用いる絶縁性液体の配合量は、100重量部のトナーに対して、10000～100重量部の範囲が好ましい。ここで配合量の下限を100重量部としたのは、これより少ないとトナーの粘度が増大し、現像剤を静電潜像に接触させる際のハンドリングが困難になること、また現像剤のカブリが著しく増加することなどの問題があるからであり、上限を10000重量部としたのは、配合量がこれより多いと、現像速度が遅く、現実の現像時間内に所望の現像画像濃度を得ることが困難になるという問題があるからである。

【0036】また、本発明のトナーは現像時に $0.05 \mu\text{m}$ ～ $2.0 \mu\text{m}$ の範囲の粒径を有することが好ましい。ここで現像時の粒径の上限を $2.0 \mu\text{m}$ としたのは、これより大きいとトナーの沈降速度が速く、現像時に静電潜像に均一にトナーを供給することが困難なので、均一性のある、緻密な現像画像が得られないという問題があるからであり、現像時の粒径の下限を $0.05 \mu\text{m}$ としたのは、これより小さいと、現像画像密度が低く、コントラストの大きい鮮明な現像画像が得られないという問題があるからである。

【0037】なお、本発明の液体现像剤においては、絶

縁性液体中に分散したトナーの帯電量を調節するために、帯電制御剤を添加することもある。代表的な帯電制御剤としては金属石鹸、スルホン化油、アルキルりん酸エステル類などがある。

【0038】また、トナーの分散助剤として脱水ひまし油などの油脂類を添加してもよい。一般に、エポキシ樹脂やポリエステル樹脂は極性が強いので、本発明で用いるような無極性の絶縁性液体中には全く溶解しない。従ってエポキシ樹脂やポリエステル樹脂を顔料で着色しこれを上記絶縁性液体中に分散させることは至難である。しかしながら、上記エポキシ樹脂やポリエステル樹脂と上記ロジンエステルおよび顔料とを適当な割合で混合したもので安定な分散体を形成せしめることができる。

【0039】さらに、バインダーとしてこのような混合樹脂を用いた場合には、次の様な効果が得られる。

【0040】まず第一に、絶縁性液体に対するトナーの分散性と、離脱性が改善される。

【0041】即ち、樹脂成分中のロジンエステル成分が膨潤ないし半溶解してトナー表面を絶縁性液体になじみ良くする結果、絶縁性液体に対するトナーの分散性が改善されるものと考えられる。また、エポキシ樹脂あるいはポリエステル樹脂がトナーの絶縁性液体の溶解を防止する結果、未定着トナー像からの絶縁性液体の離脱性が改善されるものと考えられる。

【0042】第二に、ロジンエステルとエポキシ樹脂又はポリエステル樹脂との混合比を調節することによりトナーの粒径を制御できる。即ち、絶縁性液体に対して不溶解性のエポキシ樹脂又はポリエステル樹脂成分の比率を大きくすると、トナーの粒径を大きくでき、エポキシ樹脂又はポリエステル樹脂成分の比率を小さくすると、トナーの粒径を小さくできる。

【0043】第三に、トナーの帯電量の制御が可能になる。

【0044】即ち、トナー中に半溶解状態で存在するロジンエステル成分は、この部分に電位決定イオンを安定に吸着せしめる結果、トナーの帯電量の制御が可能になるものと考えられる。

【0045】第四に、未定着トナー像の転写性が改善される。

【0046】トナーの粒径を適正な範囲に制御することにより未定着トナー像が緻密になり過ぎるのが抑制されるので、トナーの転写特性が改善されるものと考えられる。またガラス転移温度の低いエポキシ樹脂又はポリエステル樹脂の使用により、普通紙への粘着性が増すことによって、転写性が改善されるものと考えられる。第五に、転写した画像の定着性が改善される。

【0047】即ち、ガラス転移温度の低いエポキシ樹脂又はポリエステル樹脂を使用することによってトナー層が容易に熱定着できるようになるものと考えられる。

【0048】第六に、液体现像剤の寿命を伸長できる。

【0049】即ち、絶縁性液体に溶解しやすいロジンエステルは、絶縁性液体に不溶解性のエポキシ樹脂又はポリエステル樹脂と結びつけられてその溶解性が低下するので、絶縁性液中に分子状に溶解してゆくロジンエステルの量が少なくなり、現像を繰り返してもロジンエステルが濃縮されて蓄積することがなくなる。その結果、エポキシ樹脂又はポリエステル樹脂の併用によって現像液の劣化が著しく軽減され、寿命が伸長されるものと考えられる。

#### 【0050】

【発明の実施の形態】以下に本発明を実施例によって具体的に説明する。

#### 【0051】実施例1

フタロシアニンブルー（青色顔料）30重量部とロジン変性ペンタエリスリトール樹脂60重量部をニーダーにて混練し、着色マスターを得た。これにエポキシ樹脂60重量部（エピコート ガラス転移温度10°C）を加えて混練して得た混練物10重量部を、100重量部のアイソパーH（イソパラフィン 沸点（190°C））、ナフテン酸コバルト0.2重量部に加えてサンドグライNDERにて分散させ、液体現像トナーの濃縮液を得た。得られた濃縮液5重量部をアイソパーHで更に希釈し、これに正帯電潜像を有する有機感光体を浸漬したところ、現像画像として鮮明な未定着トナー像が得られた。また、現像時のトナーの粒径を測定したところ、1.0μmであった。

【0052】現像画像をブランケット上に転写した後、転写紙上に転写したところ、定着性の良好な光沢ある画像を得た。濃縮液を補給しつつ現像を繰り返し行っても現像画像が劣化することなく、再現性良く鮮明な画像が得られた。

#### 【0053】実施例2

実施例1における顔料をジメチルキナクリドンに変え、ロジン変性ペンタエリスリトール樹脂をエステルガムに変え、液状エポキシ樹脂をポリエステル樹脂（ガラス転移点30°C）に変えた他は実施例1と同様にして液体現像剤を調整した。

【0054】得られた現像剤を用いて正帯電潜像を有する有機感光体を現像したところ、鮮明な未定着トナー像が得られた。また、現像時のトナーの粒径を測定したところ、0.5μmであった。この転写画像の定着性は優れており、また濃縮液を補給しつつ現像を繰り返しても現像画像が劣化することなく、再現性良く鮮明な画像が得られた。

#### 【0055】実施例3

カーボンブラック20重量部とロジン変性マレイン酸樹脂（酸価40）80重量部とをニーダーにて混練し、着色マスターを得た。これにポリエステル樹脂（ガラス転移温度40°C）80重量部を加えて混練し、粉碎して得たトナー（平均粒径2.0μm）10重量部をアイソパーH（イソパラフィン 沸点190°C）300重量部、スルホン化油0.1重量部に加えて、液体現像トナーを得た。

10 【0056】このトナーを負帯電潜像を有する有機感光体に接触させたところ、現像画像として鮮明な未定着トナー像が得られた。このトナー像は普通紙に転写したのち120°Cのヒートロール間を通して定着画像を得た。

#### 【0057】実施例4

実施例3においてロジン変性マレイン酸樹脂120重量部、ポリエステル樹脂40重量部に替えた他は実施例3と同様に液体現像剤を調製した。現像時のトナー粒径は1.0μmとした。実施例3と同様にして得られた転写画像は120°Cのヒートロール間を通すことにより鮮明な定着画像が得られた。また現像を繰り返しても現像画像は劣化することなく、再現性良く鮮明な画像が得られた。

#### 【0058】比較例1

実施例1においてロジンエステルの添加量を110重量部とし、エポキシ樹脂を10重量部とした他は、実施例1と全く同様に現像液を調整した。得られた現像画像は、実施例1のものに比較して鮮明さを欠き、転写画像の定着性も劣るものであった。また、同一の現像液で濃縮液を追加しながら繰り返し現像を行うと数百枚の現像を繰り返した後には画像が著しく劣化した。

#### 【0059】比較例2

実施例1においてロジンエステルを全く用いずにエポキシ樹脂のみで同様に液体現像トナーを作成したところ、トナーはアイソパーH中に全く分散させることが出来なかった。

#### 【0060】

【発明の効果】上記のように、本発明の液体現像剤によれば、ロジン変成樹脂の持つ顔料分散性と絶縁性液体との良好なじみ性を保ったまま、トナーの分散安定性、絶縁性液体の離脱性が良好で、トナーの粒径や帯電量の制御を適切に行なうことができ、転写性、定着性が改善されるという、優れた実用上の効果がもたらされる。

#### 【0061】

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CLAIMS

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## Claim(s)]

Claim 1] Said toner is a liquid development agent characterized by 20 - 90 % of the weight of rosin ester and glass transition temperature containing the epoxy resin below 50-degreeC or 10 - 80 % of the weight of polyester resin, and 5 - 60 % of the weight of pigments by toner weight conversion in the liquid development agent which comes to distribute the toner in an insulating liquid.

Claim 2] Rosin ester, and an epoxy resin or polyester resin is a liquid development agent according to claim 1 blended by the rosin ester:epoxy resin or the weight ratio of polyester resin =90:10-20:80.

Claim 3] Rosin ester is a liquid development agent according to claim 1 or 2 which is what has the acid number of 10-50.

Claim 4] Rosin ester is a liquid development agent given in any 1 term of claims 1-3 which are rosin ester, the pentaerythritol ester of rosin, rosin denaturation maleic resin, or rosin denaturation FENO 1 RU resin.

Claim 5] An insulating liquid is a liquid development agent given in any 1 term of claims 1-6 which are carbon numbers 9-15 and are the isoparaffin system hydrocarbons below 200 degrees of boiling points C.

Claim 6] The toner at the time of development is a liquid development agent given in any 1 term of claims 1-5 characterized by having the particle size of the range of 0.05 micrometers - 2.0 micrometers.

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DETAILED DESCRIPTION

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## [Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the developer used for development, such as a copying machine, and relates to a detail further at the liquid development agent used for a wet-developing method.

[0002]

[Description of the Prior Art] Conventionally with image formation equipments, such as a copying machine and a laser beam printer, generally, the image information read in the manuscript is written in photo conductor drum lifting, an electrostatic latent image is formed, development in which a toner is made to adhere to this electrostatic latent image is performed, a non-established toner image is formed, subsequently to a form etc. this non-established toner image is imprinted, and it heats under application of pressure, and is established.

[0003] In case [ above-mentioned ] development is carried out, the toner to be used consists of a particle of thermoplastics, and it is known that the image of high quality with a high image consistency will be obtained at the time of the magnitude of the proper range of submicron order of the particle size of this toner.

[0004] By the way, there are two, the dry-developing method developed only using a toner and the wet-developing method developed using an insulating liquid besides a toner, in the class of the development approach, and there are the advantage and demerit in these approaches, respectively.

[0005] That is, since a dry-developing method does not use a liquid for development, while it has the advantage in which the handling of a developer is easy, since the toner which can be used is restricted to the thing of several micron order which has a comparatively large particle size, it has the demerit in which it is difficult to form a delicate image with a high gradient.

[0006] On the other hand, by the wet-developing method, since a toner with a small particle size can be used compared with a dry-developing method, while there is the advantage in which a precise and delicate image can be formed, there are the following demerits.

[0007] First, the toner used by the wet-developing method has the problem that it is difficult to obtain the toner equipped with this dispersibility and balking ease, although having the dispersibility stabilized to the insulating liquid and balking ease is called for.

[0008] That is, the toner must be equipped with the property stabilized and distributed, without precipitating in this insulating liquid or condensing. Moreover, after development is completed and a non-established toner image is formed in photo conductor drum lifting, since the insulating liquid is already unnecessary, it was called for that it is promptly removable from the formed non-established toner image, and it must be equipped with balking nature with a toner and an insulating liquid good for that purpose.

[0009] Next, although it is required to control the particle size of a toner while it is called for that the particle size of the toner which forms a non-established toner image is the proper magnitude of the range of submicron order and it is distributing in an insulating liquid for that purpose in order to obtain the image of high quality, controlling the particle size of a toner in an insulating liquid has the problem of being difficult. Furthermore, although it is called for by the wet-developing method that the amount of electrifications of a toner is proper in order to charge a toner and to obtain the image of high quality while distributing in an insulating liquid, controlling the amount of electrifications in an insulating liquid has the problem of being difficult.

[0010] Moreover, although a non-established toner image becomes precise by the wet-developing method as compared with dry process, if there is proper range also in the consistency of this non-established toner image and it becomes high density from this, a non-established toner image will become precise too much, and it will become difficult to be hard coming to separate from a photo conductor drum front face, and to imprint a non-established toner image in a



form. Therefore, although it is necessary to control the consistency which is extent which trouble does not produce in his imprint, there is a problem that it is difficult to control the consistency of this non-established toner image.

[0011] Furthermore, to the resin which generally constitutes a binder from a wet-developing method, since the ratio of pigment is high, there is a problem of being hard to be established.

[0012]

Problem(s) to be Solved by the Invention] By the wet-developing method, as mentioned above The dispersibility in the inside of an insulating liquid, the balking nature of an insulating liquid, Are advantageous at the point which can use the toner of the particle size of the range of the submicron order most suitable although there are control of particle size or the amount of electrifications, imprint nature, and a fixable problem as a toner which constitutes an image. If the above problems are conquerable, it will be a big method of developing charm at the point that the image of the high quality which is not acquired by the dry-developing method is obtained. And since the goodness of the image quality was improved in these days when especially quality improvement of an image is called for, development of the developer which can conquer the above-mentioned problem was desired.

[0013] Then, as a result of inquiring wholeheartedly, by using mixture with specific rosin ester, a specific epoxy resin, or polyester resin as a binder, this invention persons found out that the problem of the above-mentioned conventional developer for wet-developing methods was conquerable, and completed this invention.

[0014] Therefore, the dispersibility in the inside of an insulating liquid and the balking nature of an insulating liquid are good, and can perform control of particle size or the amount of electrifications appropriately, and the place made into the object of this invention has imprint nature and fixable in offering the good developer for liquid development.

[0015]

Means for Solving the Problem] The liquid development agent of this invention is characterized by making it come to distribute rosin ester and the toner with which glass transition temperature contains the epoxy resin below 50-degreeC or polyester resin, and a pigment in an insulating liquid.

[0016] In this invention, rosin ester achieves the function which makes easy control of the particle size of the toner at the time of distribution.

[0017] This rosin ester exists in the state of the dissolution or a fritting solution in the above-mentioned insulating liquid, and the solubility over this insulating liquid can be adjusted by changing the class of ester group of rosin ester. This solubility can adjust the solubility of rosin ester, as a result a toner by being related also to the acid number of rosin ester again, and choosing rosin ester with the proper acid number.

[0018] Solubility becomes good, so that the ester group of rosin ester is small. For example, when it becomes easy to dissolve when methanol ester and ethylene glycol ester are used, and glycerol ester and pentaerythritol ester are used, it is hard coming to dissolve.

[0019] Moreover, another function of rosin ester is giving the pigment dispersibility which was excellent by improving familiarity by the pigment and sticking to a pigment front face.

[0020] Furthermore, other functions of rosin ester are having the outstanding compatibility over much resin.

[0021] What has the acid number of 10-150 from this viewpoint as rosin ester used by this invention is desirable. It is on electrification nature control when making the acid number or more into ten raises the dispersibility of a pigment and a toner makes it distribute in an insulating liquid to have made the acid number into the range of 10-150 here from the reason for being desirable, and it is because the problem that the dispersibility in the inside of the insulating liquid of a toner destabilizes will arise if the acid number is higher than 150 to objection.

[0022] As rosin ester used by this invention, rosin ester, the pentaerythritol ester of rosin, rosin denaturation maleic resin, and rosin denaturation FENO 1 RU resin are mentioned.

[0023] The loadings of the rosin ester used by this invention are toner weight conversion, and 20 - 90% of the weight of its range is desirable. If [ than this ] more, having made the upper limit into 90 % of the weight here will affect a development property, or the dissolution component to the inside of the dispersion medium of rosin ester It is because there is a problem that the toner particle swollen in the dispersion medium condenses, and is because there is a problem that distributed stability in the inside of the dispersion medium of a toner particle cannot give bad and electrification nature stable to a toner easily when there is having made [ less ] the minimum into 20 % of the weight reversely than this.

[0024] As for the epoxy resin or polyester resin used by this invention, it is called for that glass transition temperature is below 50-degreeC. It is because fixable [ of a toner ] will fall if having made glass transition temperature below into 50-degreeC here has a glass transition temperature higher than this.

[0025] If still easier, in order to close fixable, it is desirable for it to be still lower, for example, to set the glass transition temperature of these resin as -20-degree C-30-degree about C range.

[0026] If the epoxy resin or polyester resin used by this invention is insoluble to a dispersion medium, it can close the resinous principle of a toner particle, and it is made to be able to function as a thermoplastic particle which the toner is colored, and the resin typically made from bisphenol A and epichlorohydrin and these denaturation objects can be used.

[0027] As other examples of the epoxy resin used by this invention, a phenol novolak mold epoxy resin, a cresol novolak mold epoxy resin, an annular aliphatic series epoxy resin, a glycidyl ester system epoxy resin, and a glycidyl phthalate system epoxy resin are mentioned. Moreover, as polyester resin, the condensate of polybasic acid, such as a phthalic acid, isophthalic acid, and trimellitic acid, and polyhydric alcohol, such as bisphenol A, butanediol, ethylene glycol, and a glycerol, is mentioned.

[0028] The loadings of the epoxy resin used by this invention or polyester resin are toner weight conversion, and 10 - 30% of the weight of its range is desirable. It becomes difficult for the distributed stability to the inside of the dispersion medium of a toner to deteriorate, if there is to have made [ more ] the upper limit into 80 % of the weight here than this, and to give proper electrification to a toner. Furthermore, it is because there is a problem that the dispersibility of a pigment also worsens, and is because there is a problem that the dissolution component which a toner becomes easy to dissolve in a dispersion medium, and was accumulated with development degrades a development property when there is having made [ less ] the minimum into 10 % of the weight than this.

[0029] In this invention, a pigment has the function to give a color to a toner, and carbon black, a copper phthalocyanine blue, dimethyl Quinacridone, carmine red, and benzidine yellow are mentioned as a pigment used for this invention.

[0030] The loadings of the pigment used by this invention are toner weight conversion, and 5 - 60% of the weight of its range is desirable. It is because there is a problem that the image which fixation of a toner becomes difficult and is glossy is not obtained when there is having made [ more ] the upper limit into 60 % of the weight here than this, and is because there is a problem that a developer cannot reach concentration deep enough when there is having made [ less ] the minimum into 5 % of the weight than this.

[0031] Moreover, as for rosin ester and an above-mentioned epoxy resin, or above-mentioned polyester resin, it is desirable to be blended by the rosin ester:epoxy resin or the weight ratio of the range of polyester resin =90:10-20:80. If the rate of the rosin ester to an epoxy resin or polyester resin becomes less than 20:80, the distributed stability in the inside of the dispersion medium of a toner will worsen. It is because there is a problem that it becomes difficult to give proper electrification to a toner. When the rate of the rosin ester to an epoxy resin or polyester resin increases more than 90:10 reversely, the increase of a dissolution-into dispersion medium of toner component, It is because there is a problem that this increases further, and degrade a developer or condensation of a toner particle becomes easy to take place when development is continued.

[0032] The insulating liquid used by this invention functions as an insulating liquid which distributes a developer.

[0033] As an insulating liquid used by this invention, the organic liquid which has the insulation resistance of 1013ohms or more is desirable. It is because there is a problem that the charge of an electrostatic latent image is revealed and development image concentration falls at the time of development when having set insulation resistance to 1013ohms or more here has insulation resistance lower than 1013 ohms.

[0034] As an insulating liquid used by this invention, liquefied paraffin, silicone oil, kerosine, straight mineral oil, and machine oil are mentioned. Among these, especially desirable things are carbon numbers 9-15, and the isoparaffin system hydrocarbon below 200 degrees of boiling points C is excellent in handling nature from the point which a developer can vaporize and dry.

[0035] The loadings of the insulating liquid used by this invention have the desirable range of the 10000 - 100 weight section to the toner of the 100 weight sections. Having made the minimum of loadings into the 100 weight sections here The handling at the time of the viscosity of a toner increasing, if fewer than this, and contacting a developer to an electrostatic latent image becomes difficult. Moreover, it is because there are problems, like fogging of a developer increases remarkably, and is because there is a problem that a development rate will be slow and it will become difficult to obtain desired development image concentration in actual developing time if having made the upper limit into the 10000 weight sections has more loadings than this.

[0036] Moreover, as for the toner of this invention, it is desirable to have the particle size of the range of 0.05 micrometers - 2.0 micrometers at the time of development. Having set the upper limit of the particle size at the time of development to 2.0 micrometers here Since the settling velocity of a toner is quick and it is difficult at the time of development to supply a toner at homogeneity at an electrostatic latent image if larger than this It is because there is a problem with homogeneity that a precise development image is not obtained, and is because there is a problem that a development image consistency will be low and the clear large development image of contrast will not be obtained if it

smaller than this to have set the minimum of the particle size at the time of development to 0.05 micrometers.

0037] In addition, in the liquid development agent of this invention, in order to adjust the amount of electrifications of the toner distributed in the insulating liquid, an electrification control agent may be added. As a typical electrification control agent, there are metallic soap, sulfonated oil, and alkyl phosphoric ester.

0038] Moreover, fats and oils, such as dehydrated castor oil, may be added as a distributed assistant of a toner.

Generally, since an epoxy resin and polyester resin have the strong polarity, into a non-polar insulating liquid which is used by this invention, it does not dissolve at all. Therefore, it is most difficult for a pigment to color an epoxy resin and polyester resin and to distribute this in the above-mentioned insulating liquid. However, a stable dispersing element can be made to form in what mixed the above-mentioned epoxy resin, polyester resin, the above-mentioned rosin ester, and a pigment at a suitable rate.

0039] Furthermore, the following effectiveness is acquired when such mixed resin is used as a binder.

0040] In the first place, the dispersibility and balking nature of the toner to an insulating liquid are improved first.

0041] That is, as a result of the rosin ester component in a resinous principle carrying out swelling thru/or a fritting solution and concordance's improving a toner front face an insulating liquid, it is thought that the dispersibility of the toner to an insulating liquid is improved. Moreover, as a result of an epoxy resin or polyester resin preventing the dissolution of the insulating liquid of a toner, it is thought that the balking nature of the insulating liquid from a non-established toner image is improved.

0042] The particle size of a toner is controllable by second adjusting a mixing ratio with rosin ester, an epoxy resin, or polyester resin. That is, if the epoxy resin of insolubility or the ratio of a polyester resin component is enlarged to an insulating liquid, particle size of a toner can be enlarged, and if the ratio of an epoxy resin or a polyester resin component is made small, particle size of a toner can be made small.

0043] Control of the amount of electrifications of a toner is attained [ third ].

0044] That is, as a result of the rosin ester component which exists in the state of a fritting solution in a toner making this part adsorb potential decision ion at stability, control of the amount of electrifications of a toner is considered to become possible.

0045] The imprint nature of a non-established toner image is improved by the fourth.

0046] Since it is controlled that a non-established toner image becomes precise too much by controlling the particle size of a toner in the proper range, it is considered that the imprint property of a toner is improved. Moreover, by the activity of an epoxy resin or polyester resin with a low glass transition temperature, when the adhesiveness to a regular paper increases, it is thought that imprint nature is improved. Fixable [ of the image imprinted to the fifth ] is improved.

0047] That is, coming that it can carry out the heat fixation of the toner layer easily is thought by using the low epoxy resin or the polyester resin of glass transition temperature.

0048] The life of a liquid development agent can be elongated to the sixth.

0049] That is, since it is connected to an insulating liquid with the epoxy resin of insolubility, or polyester resin and the solubility falls, even if the amount of rosin ester which is easy to dissolve in an insulating liquid of the rosin ester dissolved in the shape of a molecule into insulating liquid decreases and it repeats development, rosin ester being condensed and accumulating of it is lost. Consequently, degradation of a developer is remarkably mitigated by concomitant use of an epoxy resin or polyester resin, and it is thought that a life is elongated.

0050]

[Embodiment of the Invention] An example explains this invention concretely below.

0051] The example 1 copper-phthalocyanine-blue (blue pigment) 30 weight section and the rosin denaturation pentaerythritol resin 60 weight section were kneaded by the kneader, and the coloring master was obtained. The \*\*\*\*\* 10 weight section which added, kneaded and obtained the epoxy resin 60 weight section (Epicoat glass-transition-temperature C of 10 degrees) to this was added to Isopar H of the 100 weight sections (isoparaffin boiling point (190-degreeC)), and the naphthenic-acid cobalt 0.2 weight section, and was distributed with the Sand grinder, and the concentration liquid of a liquid development toner was obtained. The obtained concentration liquid 5 weight section was further diluted with Isopar H, and when the organic photo conductor which has a forward electrification latent image in this was immersed, the non-established toner image clear as a development image was obtained. Moreover, it was 1.0 micrometers when the particle size of the toner at the time of development was measured.

0052] After imprinting a development image on a blanket, when it imprinted on the transfer paper, the fixable good glossy image was obtained. The clear image with sufficient repeatability was obtained without having repeated development and a development image deteriorating as a line, supplying concentration liquid.

0053] Changed the pigment in example 2 example 1 into dimethyl Quinacridone, changed rosin denaturation

entaerythritol resin into rosin ester, and the liquefied epoxy resin was changed into polyester resin (30 degree C of glass transition points), and also the liquid \*\*\*\* agent was adjusted like the example 1.

[0054] When the organic photo conductor which has a forward electrification latent image using the obtained developer was developed, the clear non-established toner image was obtained. Moreover, it was 0.5 micrometers when the particle size of the toner at the time of development was measured. The clear image with sufficient repeatability was obtained without a development image deteriorating, even if it repeated development, fixable [ of this transfer picture ] being excellent, and supplying concentration liquid.

[0055] The example 3 carbon-black 20 weight section and the rosin denaturation maleic resin (acid number 40) 80 weight section were kneaded by the kneader, and the coloring master was obtained. the toner (mean particle diameter of 2.0 micrometers) 10 weight section which added, kneaded, ground and obtained the polyester resin (glass-transition-temperature C of 40 degrees) 80 weight section to this -- the Isopar H(190 degrees of isoparaffin boiling points (C)) 300 weight section, and the sulfonated oil 0.1 weight section -- in addition, the liquid development toner was obtained.

[0056] When this toner was contacted to the organic photo conductor which has a negative electrification latent image, the non-established toner image clear as a development image was obtained. After imprinting this toner image in a regular paper, it obtained the fixation image through between the heat rolls of 120-degreeC.

[0057] In example 4 example 3, it changed to the rosin denaturation maleic resin 120 weight section and the polyester resin 40 weight section, and also the liquid development agent was prepared like the example 3. Toner particle size at the time of development was set to 1.0 micrometers. When the transfer picture obtained like the example 3 let between the heat rolls of 120-degreeC pass, the clear fixation image was obtained. Moreover, even if it repeated development, the clear image with sufficient repeatability was obtained, without a development image deteriorating.

[0058] In example of comparison 1 example 1, made the addition of rosin ester into the 110 weight sections, and the epoxy resin was made into 10 weight sections, and also the developer was adjusted completely like the example 1. The obtained development image was that in which is not clear as compared with the thing of an example 1, and fixable [ of a transfer picture ] is inferior. Moreover, when negatives were developed repeatedly, adding concentration liquid with the same developer, after repeating the development of hundreds of sheets, the image deteriorated remarkably.

[0059] When \*\*\*\*\* NA was similarly created only with the epoxy resin, without using rosin ester at all in example of comparison 2 example 1, the toner was not completely able to be distributed in Isopar H.

[0060]

[Effect of the Invention] As mentioned above, according to the liquid development agent of this invention, with the good concordance nature of the pigment dispersibility and the insulating liquid which rosin conversion resin has maintained, the distributed stability of a toner and the balking nature of an insulating liquid are good, and can perform appropriately control of the particle size of a toner, or the amount of electrifications, and the outstanding practical effectiveness [ say / that imprint nature and fixable are improved ] is brought about.

[0061]

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TECHNICAL FIELD

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Field of the Invention] This invention relates to the developer used for development, such as a copying machine, and  
elates to a detail further at the liquid development agent used for a wet-developing method.

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PRIOR ART

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[Description of the Prior Art] Conventionally with image formation equipments, such as a copying machine and a laser beam printer, generally, the image information read in the manuscript is written in photo conductor drum lifting, an electrostatic latent image is formed, development in which a toner is made to adhere to this electrostatic latent image is performed, a non-established toner image is formed, subsequently to a form etc. this non-established toner image is imprinted, and it heats under application of pressure, and is established.

[0003] In case [ above-mentioned ] development is carried out, the toner to be used consists of a particle of thermoplastics, and it is known that the image of high quality with a high image consistency will be obtained at the time of the magnitude of the proper range of submicron order of the particle size of this toner.

[0004] By the way, there are two, the dry-developing method developed only using a toner and the wet-developing method developed using an insulating liquid besides a toner, in the class of the development approach, and there are the advantage and demerit in these approaches, respectively.

[0005] That is, since a dry-developing method does not use a liquid for development, while it has the advantage in which the handling of a developer is easy, since the toner which can be used is restricted to the thing of several micron order which has a comparatively large particle size, it has the demerit in which it is difficult to form a delicate image with a high gradient.

[0006] On the other hand, by the wet-developing method, since a toner with a small particle size can be used compared with a dry-developing method, while there is the advantage in which a precise and delicate image can be formed, there are the following demerits.

[0007] First, the toner used by the wet-developing method has the problem that it is difficult to obtain the toner equipped with this dispersibility and balking ease, although having the dispersibility stabilized to the insulating liquid and balking ease is called for.

[0008] That is, the toner must be equipped with the property stabilized and distributed, without precipitating in this insulating liquid or condensing. Moreover, after development is completed and a non-established toner image is formed in photo conductor drum lifting, since the insulating liquid is already unnecessary, it was called for that it is promptly removable from the formed non-established toner image, and it must be equipped with balking nature with a toner and an insulating liquid good for that purpose.

[0009] Next, although it is required to control the particle size of a toner while it is called for that the particle size of the toner which forms a non-established toner image is the proper magnitude of the range of submicron order and it is distributing in an insulating liquid for that purpose in order to obtain the image of high quality, controlling the particle size of a toner in an insulating liquid has the problem of being difficult. Furthermore, although it is called for by the wet-developing method that the amount of electrifications of a toner is proper in order to charge a toner and to obtain the image of high quality while distributing in an insulating liquid, controlling the amount of electrifications in an insulating liquid has the problem of being difficult.

[0010] Moreover, although a non-established toner image becomes precise by the wet-developing method as compared with dry process, if there is proper range also in the consistency of this non-established toner image and it becomes high density from this, a non-established toner image will become precise too much, and it will become difficult to be hard coming to separate from a photo conductor drum front face, and to imprint a non-established toner image in a form. Therefore, although it is necessary to control in the consistency which is extent which trouble does not produce in this imprint, there is a problem that it is difficult to control the consistency of this non-established toner image.

[0011] Furthermore, to the resin which generally constitutes a binder from a wet-developing method, since the ratio of a pigment is high, there is a problem of being hard to be established.

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EFFECT OF THE INVENTION

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[Effect of the Invention] As mentioned above, according to the liquid development agent of this invention, with the good concordance nature of the pigment dispersibility and the insulating liquid which rosin conversion resin has maintained, the distributed stability of a toner and the balking nature of an insulating liquid are good, and can perform appropriately control of the particle size of a toner, or the amount of electrifications, and the outstanding practical effectiveness [ say / that imprint nature and fixable are improved ] is brought about.

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TECHNICAL PROBLEM

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Problem(s) to be Solved by the Invention] By the wet-developing method, as mentioned above The dispersibility in the inside of an insulating liquid, the balking nature of an insulating liquid, Are advantageous at the point which can use the toner of the particle size of the range of the submicron order most suitable although there are control of particle size or the amount of electrifications, imprint nature, and a fixable problem as a toner which constitutes an image. If the above problems are conquerable, it will be a big method of developing charm at the point that the image of the high quality which is not acquired by the dry-developing method is obtained. And since the goodness of the image quality was improved in these days when especially quality improvement of an image is called for, development of the developer which can conquer the above-mentioned problem was desired.

[0013] Then, as a result of inquiring wholeheartedly, by using mixture with specific rosin ester, a specific epoxy resin, or polyester resin as a binder, this invention persons found out that the problem of the above-mentioned conventional developer for wet-developing methods was conquerable, and completed this invention.

[0014] Therefore, the dispersibility in the inside of an insulating liquid and the balking nature of an insulating liquid are good, and can perform control of particle size or the amount of electrifications appropriately, and the place made into the object of this invention has imprint nature and fixable in offering the good developer for liquid development.

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MEANS

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[Means for Solving the Problem] The liquid development agent of this invention is characterized by making it come to distribute rosin ester and the toner with which glass transition temperature contains the epoxy resin below 50-degreeC or polyester resin, and a pigment in an insulating liquid.

[0016] In this invention, rosin ester achieves the function which makes easy control of the particle size of the toner at the time of distribution.

[0017] This rosin ester exists in the state of the dissolution or a fritting solution in the above-mentioned insulating liquid, and the solubility over this insulating liquid can be adjusted by changing the class of ester group of rosin ester. This solubility can adjust the solubility of rosin ester, as a result a toner by being related also to the acid number of rosin ester again, and choosing rosin ester with the proper acid number.

[0018] Solubility becomes good, so that the ester group of rosin ester is small. For example, when it becomes easy to dissolve when methanol ester and ethylene glycol ester are used, and glycerol ester and pentaerythritol ester are used, it is hard coming to dissolve.

[0019] Moreover, another function of rosin ester is giving the pigment dispersibility which was excellent by improving familiarity by the pigment and sticking to a pigment front face.

[0020] Furthermore, other functions of rosin ester are having the outstanding compatibility over much resin.

[0021] What has the acid number of 10-150 from this viewpoint as rosin ester used by this invention is desirable. It is on electrification nature control when making the acid number or more into ten raises the dispersibility of a pigment and a toner makes it distribute in an insulating liquid to have made the acid number into the range of 10-150 here from the reason for being desirable, and it is because the problem that the dispersibility in the inside of the insulating liquid of a toner destabilizes will arise if the acid number is higher than 150 to objection.

[0022] As rosin ester used by this invention, rosin ester, the pentaerythritol ester of rosin, rosin denaturation maleic resin, and rosin denaturation FENO 1 RU resin are mentioned.

[0023] The loadings of the rosin ester used by this invention are toner weight conversion, and 20 - 90% of the weight of its range is desirable. If [ than this ] more, having made the upper limit into 90 % of the weight here will affect a development property, or the dissolution component to the inside of the dispersion medium of rosin ester. It is because there is a problem that the toner particle swollen in the dispersion medium condenses, and is because there is a problem that distributed stability in the inside of the dispersion medium of a toner particle cannot give bad and electrification nature stable to a toner easily when there is having made [ less ] the minimum into 20 % of the weight reversely than this.

[0024] As for the epoxy resin or polyester resin used by this invention, it is called for that glass transition temperature is below 50-degreeC. It is because fixable [ of a toner ] will fall if having made glass transition temperature below into 50-degreeC here has a glass transition temperature higher than this.

[0025] If still easier, in order to close fixable, it is desirable for it to be still lower, for example, to set the glass transition temperature of these resin as -20-degree C-30-degree about C range.

[0026] If the epoxy resin or polyester resin used by this invention is insoluble to a dispersion medium, it can close the resinous principle of a toner particle, and it is made to be able to function as a thermoplastic particle which the toner colored, and the resin typically made from bisphenol A and epichlorohydrin and these denaturation objects can be used.

[0027] As other examples of the epoxy resin used by this invention, a phenol novolak mold epoxy resin, a cresol novolak mold epoxy resin, an annular aliphatic series epoxy resin, a glycidyl ester system epoxy resin, and a glycidyl phthalate system epoxy resin are mentioned. Moreover, as polyester resin, the condensate of polybasic acid, such as a phthalic acid, isophthalic acid, and trimellitic acid, and polyhydric alcohol, such as bisphenol A, butanediol, ethylene

lycol, and a glycerol, is mentioned.

0028] The loadings of the epoxy resin used by this invention or polyester resin are toner weight conversion, and 10 - 80% of the weight of its range is desirable. It becomes difficult for the distributed stability to the inside of the dispersion medium of a toner to deteriorate, if there is to have made [ more ] the upper limit into 80 % of the weight here than this, and to give proper electrification to a toner, Furthermore, it is because there is a problem that the dispersibility of a pigment also worsens, and is because there is a problem that the dissolution component which a toner becomes easy to dissolve in a dispersion medium, and was accumulated with development degrades a development property when there is having made [ less ] the minimum into 10 % of the weight than this.

0029] In this invention, a pigment has the function to give a color to a toner, and carbon black, a copper phthalocyanine blue, dimethyl Quinacridone, carmine red, and benzidine yellow are mentioned as a pigment used for this invention.

0030] The loadings of the pigment used by this invention are toner weight conversion, and 5 - 60% of the weight of its range is desirable. It is because there is a problem that the image which fixation of a toner becomes difficult and is glossy is not obtained when there is having made [ more ] the upper limit into 60 % of the weight here than this, and is because there is a problem that a developer cannot reach concentration deep enough when there is having made [ less ] the minimum into 5 % of the weight than this.

0031] Moreover, as for rosin ester and an above-mentioned epoxy resin, or above-mentioned polyester resin, it is desirable to be blended by the rosin ester:epoxy resin or the weight ratio of the range of polyester resin =90:10-20:80. If the rate of the rosin ester to an epoxy resin or polyester resin becomes less than 20:80, the distributed stability in the inside of the dispersion medium of a toner will worsen. It is because there is a problem that it becomes difficult to give proper electrification to a toner. When the rate of the rosin ester to an epoxy resin or polyester resin increases more than 90:10 reversely, the increase of a dissolution-into dispersion medium of toner component, It is because there is a problem that this increases further, and degrade a developer or condensation of a toner particle becomes easy to take place when development is continued.

0032] The insulating liquid used by this invention functions as an insulating liquid which distributes a developer.

0033] As an insulating liquid used by this invention, the organic liquid which has the insulation resistance of 1013ohms or more is desirable. It is because there is a problem that the charge of an electrostatic latent image is revealed and development image concentration falls at the time of development when having set insulation resistance to 1013ohms or more here has insulation resistance lower than 1013 ohms.

0034] As an insulating liquid used by this invention, liquefied paraffin, silicone oil, kerosine, straight mineral oil, and machine oil are mentioned. Among these, especially desirable things are carbon numbers 9-15, and the isoparaffin system hydrocarbon below 200 degrees of boiling points C is excellent in handling nature from the point which a developer can vaporize and dry.

0035] The loadings of the insulating liquid used by this invention have the desirable range of the 10000 - 100 weight section to the toner of the 100 weight sections. Having made the minimum of loadings into the 100 weight sections here The handling at the time of the viscosity of a toner increasing, if fewer than this, and contacting a developer to an electrostatic latent image becomes difficult, Moreover, it is because there are problems, like fogging of a developer increases remarkably, and is because there is a problem that a development rate will be slow and it will become difficult to obtain desired development image concentration in actual developing time if having made the upper limit into the 10000 weight sections has more loadings than this.

0036] Moreover, as for the toner of this invention, it is desirable to have the particle size of the range of 0.05 micrometers - 2.0 micrometers at the time of development. Having set the upper limit of the particle size at the time of development to 2.0 micrometers here Since the settling velocity of a toner is quick and it is difficult at the time of development to supply a toner at homogeneity at an electrostatic latent image if larger than this It is because there is a problem with homogeneity that a precise development image is not obtained, and is because there is a problem that a development image consistency will be low and the clear large development image of contrast will not be obtained if it is smaller than this to have set the minimum of the particle size at the time of development to 0.05 micrometers.

0037] In addition, in the liquid development agent of this invention, in order to adjust the amount of electrifications of the toner distributed in the insulating liquid, an electrification control agent may be added. As a typical electrification control agent, there are metallic soap, sulfonated oil, and alkyl phosphoric ester.

0038] Moreover, fats and oils, such as dehydrated castor oil, may be added as a distributed assistant of a toner. Generally, since an epoxy resin and polyester resin have the strong polarity, into a non-polar insulating liquid which is used by this invention, it does not dissolve at all. Therefore, it is most difficult for a pigment to color an epoxy resin and polyester resin and to distribute this in the above-mentioned insulating liquid. However, a stable dispersing element

can be made to form in what mixed the above-mentioned epoxy resin, polyester resin, the above-mentioned rosin ester, and a pigment at a suitable rate.

[0039] Furthermore, the following effectiveness is acquired when such mixed resin is used as a binder.

[0040] In the first place, the dispersibility and balking nature of the toner to an insulating liquid are improved first.

[0041] That is, as a result of the rosin ester component in a resinous principle carrying out swelling thru/or a fritting solution and concordance's improving a toner front face an insulating liquid, it is thought that the dispersibility of the toner to an insulating liquid is improved. Moreover, as a result of an epoxy resin or polyester resin preventing the dissolution of the insulating liquid of a toner, it is thought that the balking nature of the insulating liquid from a non-established toner image is improved.

[0042] The particle size of a toner is controllable by second adjusting a mixing ratio with rosin ester, an epoxy resin, or polyester resin. That is, if the epoxy resin of insolubility or the ratio of a polyester resin component is enlarged to an insulating liquid, particle size of a toner can be enlarged, and if the ratio of an epoxy resin or a polyester resin component is made small, particle size of a toner can be made small.

[0043] Control of the amount of electrifications of a toner is attained [ third ].

[0044] That is, as a result of the rosin ester component which exists in the state of a fritting solution in a toner making this part adsorb potential decision ion at stability, control of the amount of electrifications of a toner is considered to become possible.

[0045] The imprint nature of a non-established toner image is improved by the fourth.

[0046] Since it is controlled that a non-established toner image becomes precise too much by controlling the particle size of a toner in the proper range, it is considered that the imprint property of a toner is improved. Moreover, by the activity of an epoxy resin or polyester resin with a low glass transition temperature, when the adhesiveness to a regular paper increases, it is thought that imprint nature is improved. Fixable [ of the image imprinted to the fifth ] is improved.

[0047] That is, coming that it can carry out the heat fixation of the toner layer easily is thought by using the low epoxy resin or the polyester resin of glass transition temperature.

[0048] The life of a liquid development agent can be elongated to the sixth.

[0049] That is, since it is connected to an insulating liquid with the epoxy resin of insolubility, or polyester resin and the solubility falls, even if the amount of rosin ester which is easy to dissolve in an insulating liquid of the rosin ester dissolved in the shape of a molecule into insulating liquid decreases and it repeats development, rosin ester being condensed and accumulating of it is lost. Consequently, degradation of a developer is remarkably mitigated by concomitant use of an epoxy resin or polyester resin, and it is thought that a life is elongated.

[0050]

[Embodiment of the Invention] An example explains this invention concretely below.

[0051] The example 1 copper-phthalocyanine-blue (blue pigment) 30 weight section and the rosin denaturation pentaerythritol resin 60 weight section were kneaded by the kneader, and the coloring master was obtained. The \*\*\*\*\* 10 weight section which added, kneaded and obtained the epoxy resin 60 weight section (Epicoat glass-transition-temperature C of 10 degrees) to this was added to Isopar H of the 100 weight sections (isoparaffin boiling point (190-degreeC)), and the naphthenic-acid cobalt 0.2 weight section, and was distributed with the Sand grinder, and the concentration liquid of a liquid development toner was obtained. The obtained concentration liquid 5 weight section was further diluted with Isopar H, and when the organic photo conductor which has a forward electrification latent image in this was immersed, the non-established toner image clear as a development image was obtained. Moreover, it was 1.0 micrometers when the particle size of the toner at the time of development was measured.

[0052] After imprinting a development image on a blanket, when it imprinted on the transfer paper, the fixable good glossy image was obtained. The clear image with sufficient repeatability was obtained without having repeated development and a development image deteriorating as a line, supplying concentration liquid.

[0053] Changed the pigment in example 2 example 1 into dimethyl Quinacridone, changed rosin denaturation pentaerythritol resin into rosin ester, and the liquefied epoxy resin was changed into polyester resin (30 degree C of glass transition points), and also the liquid \*\*\*\* agent was adjusted like the example 1.

[0054] When the organic photo conductor which has a forward electrification latent image using the obtained developer was developed, the clear non-established toner image was obtained. Moreover, it was 0.5 micrometers when the particle size of the toner at the time of development was measured. The clear image with sufficient repeatability was obtained without a development image deteriorating, even if it repeated development, fixable [ of this transfer picture ] being excellent, and supplying concentration liquid.

[0055] The example 3 carbon-black 20 weight section and the rosin denaturation maleic resin (acid number 40) 80

weight section were kneaded by the kneader, and the coloring master was obtained. the toner (mean particle diameter of 2.0 micrometers) 10 weight section which added, kneaded, ground and obtained the polyester resin (glass-transition-temperature C of 40 degrees) 80 weight section to this -- the Isopar H(190 degrees of isoparaffin boiling points (C)) 100 weight section, and the sulfonated oil 0.1 weight section -- in addition, the liquid development toner was obtained. [0056] When this toner was contacted to the organic photo conductor which has a negative electrification latent image, the non-established toner image clear as a development image was obtained. After imprinting this toner image in a regular paper, it obtained the fixation image through between the heat rolls of 120-degreeC.

[0057] In example 4 example 3, it changed to the rosin denaturation maleic resin 120 weight section and the polyester resin 40 weight section, and also the liquid development agent was prepared like the example 3. Toner particle size at the time of development was set to 1.0 micrometers. When the transfer picture obtained like the example 3 let between the heat rolls of 120-degreeC pass, the clear fixation image was obtained. Moreover, even if it repeated development, the clear image with sufficient repeatability was obtained, without a development image deteriorating.

[0058] In example of comparison 1 example 1, made the addition of rosin ester into the 110 weight sections, and the epoxy resin was made into 10 weight sections, and also the developer was adjusted completely like the example 1. The obtained development image was that in which is not clear as compared with the thing of an example 1, and fixable [ of a transfer picture ] is inferior. Moreover, when negatives were developed repeatedly, adding concentration liquid with the same developer, after repeating the development of hundreds of sheets, the image deteriorated remarkably.

[0059] When \*\*\*\*\* NA was similarly created only with the epoxy resin, without using rosin ester at all in example of comparison 2 example 1, the toner was not completely able to be distributed in Isopar H.

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